What is claimed is: 1, 4 5 6 7 12 18

Sub A1

1. A temperature compensating reflective resonator comprising:

a first light transmissive material;

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a second light transmissive material; and

wherein the first and second light transmissive materials cooperate with one another in manner which mitigates changes in an optical path length of the reflective resonator due to changes in temperature. .

2. The temperature compensating reflective resonator as recited in claim 1, wherein:

the first light transmissive material comprises a substantially solid material; and

the second light transmissive material comprises a substantially flexible material.

3. The temperature compensating reflective resonator as recited in claim 1, wherein:

the first light transmissive material comprises a solid material; and

the second light transmissive material comprises a material selected from the group consisting of:

air;

vacuum; and

liquid.

4. A temperature compensating reflective resonator comprising:

a solid light transmissive material;

a reflector;

a gap formed between the solid light transmissive material and the reflector;

a spacer defining a distance between a front surface of the solid light transmissive material and the reflector;

wherein a thermal coefficient of optical path length is given by the formula

$$\alpha_{OP} = \frac{1}{OP}\frac{dOP}{dT} \approx \frac{1}{n_g}\frac{dn_g}{dT} + \frac{1}{L_g}\frac{dL_g}{dT}\frac{n_g - n_a}{n_g} + \frac{L_a}{L_g}\frac{dn_a}{dT}\frac{1}{n_g} + \frac{n_a}{n_g L}\frac{dL}{dT}$$

$$= \alpha_n + \alpha_L \frac{n_g - n_a}{n_g} + \alpha_a \frac{n_a L_a}{n_g L_g} + \alpha_{ULE}\frac{n_a}{n_g} \qquad (11)$$

wherein α_n is the thermal coefficient of the refractive index for the solid light transmissive material, α_L is the thermal expansion coefficient for the solid light transmissive material;

n_g is index of refraction for the solid light transmissive material, n_a is the index of refraction for a material dispose intermediate the solid light transmissive material and the reflector, α_a is the thermal coefficient of refractive index for the material dispose intermediate the solid light transmissive material and the reflector, L_a is the distance between the solid light transmissive

material and the reflector, L_g is the thickness of the solid light transmissive material, and α_{ULE} is the thermal coefficient of expansion for the spacer; and

wherein the thermal coefficient of optical path length is mitigated by at least one of:

minimizing terms of Equation (11);

substantially canceling the terms among one another of Equation (11).

5. A temperature compensating reflective resonator comprising:

a solid light transmissive material;

a reflector;

a gap formed between the solid light transmissive material and the reflector;

a spacer defining a distance between a front surface of the solid light transmissive material and the reflector;

wherein a thermal coefficient of optical path length is given by the formula

$$\alpha_{OP} = \frac{1}{OP}\frac{dOP}{dT} \approx \frac{1}{n_g}\frac{dn_g}{dT} + \frac{1}{L_g}\frac{dL_g}{dT}\frac{n_g - n_a}{n_g} + \frac{L_a}{L_g}\frac{dn_a}{dT}\frac{1}{n_g} + \frac{n_a}{n_g L}\frac{dL}{dT}$$

$$= \alpha_n + \alpha_L \frac{n_g - n_a}{n_g} + \alpha_a \frac{n_a L_a}{n_g L_g} + \alpha_{ULE}\frac{n_a}{n_g} \qquad (11)$$

wherein α_n is the thermal coefficient of the refractive index for the solid light transmissive material, α_L is the thermal expansion coefficient for the solid light transmissive material;

n_g is index of refraction for the solid light transmissive material, n_a is the index of refraction for a material dispose intermediate the solid light transmissive material and the reflector, α_a is the thermal coefficient of refractive index for the material dispose intermediate the solid light transmissive material and the reflector, L_a is the distance between the solid light transmissive material and the reflector, L_g is the thickness of the solid light transmissive material, and α_{ULE} is the thermal coefficient of expansion for the spacer; and

Wherein the thermal coefficient of optical path length is mitigated by configuring the resonate reflector such that the first two terms of Eq. (11) substantially cancel one another, L_g is much greater than L_a such that the third term of Eq. (11) is approximately zero, and α_{ULE} is substantially zero.

6. A laser frequency locker comprising:

a laser cavity;

at least one reflective resonator disposed at least one end of the laser cavity, the reflective resonator comprising:

a first light transmissive material;

a second light transmissive material; and

wherein the first and second light transmissive materials cooperate with one another in manner which mitigates changes in an optical path length of the reflective resonator due to changes in temperature.

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7. A temperature compensating reflective resonator comprising:

a light transmitting material having a front surface and a back surface;

a reflector configured to reflect approximately 100% of light incident thereon;

a holder configured to hold the front surface of the light transmitting material at approximately a fixed distance with respect to the reflector; and

wherein the light transmitting material, the reflector and the holder are configured so as to define a gap intermediate the back surface of the light transmitting material and the reflector.

8. The temperature compensating reflective resonator as recited in claim 7, wherein the light transmitting material comprises glass.

9. The temperature compensating reflective resonator as recited in claim 7, wherein the light transmitting material comprises Ohara Corporation S-FPL51 glass.

112, it is not clear. How can applicant can claim the name

used, Ohara corp.

10. The temperature compensating reflective resonator as recited in claim 7, wherein:

the front surface of the light transmitting material has a reflection coefficient which is approximately zero or greater than zero; and

the back surface of the light transmitting material has a reflection coefficient which is approximately equal to zero.

11. The temperature compensating reflective resonator as recited in claim 7, wherein the reflector comprises a mirror.

12. The temperature compensating reflective resonator as recited in claim 7, wherein the holder comprises an ultra-low expansion material.

13. The temperature compensating reflective resonator as recited in claim 7, wherein the holder comprises a material having a thermal expansion coefficient of approximately 0.1 ppm/°C.

14. The temperature compensating reflective resonator as recited in claim 7, wherein the holder comprises Ohara Corporation Clearcream glass.

15. The temperature compensating reflective resonator as recited in claim 7, wherein a thickness of light transmitting material is much larger than a thickness of the gap.

16. The temperature compensating reflective resonator as recited in claim 7, wherein the light transmitting material, the reflector and the holder define a Gires-Tournois resonator.

17. A method for mitigating undesirable efforts due to temperative changes in a reflective resonator or the like, the method comprising;

holding a front surface of a light transmitting material approximately a fixed distance from a reflector;

wherein at least two contributing terms of Equation (11) substantially cancel one another; and

wherein the rest of the contributing terms of Equation (11) are approximately minimized.

18. A method for mitigating undesirable effects due to temperature changes in a reflective resonator, the method comprising:

holding a front surface of a light transmitting material approximately a fixed distance from a reflector; and

wherein each contributing term in Equation (11) substantially cancel one another.